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July 21, 1994

Defense Technical Information Center
Building 5, Cameron Station
Alexandria, VA 22304-6145

Dear Sir:

In compliance with the reporting requirements of Grant No N00014-92-J-1301, entitled *Acquisition of a Gas Source Mass Spectrometer for Paleoclimatology and Paleoceanography Research,* Principal Investigator William B. Curry, enclosed is a copy of the final report.

William B. Curry (kwb)

William B. Curry
Principal Investigator

WBC/kwb
Enclosure

Final Project Report - ONR Grant N00014-92-J-1301

Acquisition of a Gas Source Mass Spectrometer for Paleoclimatology and Paleoceanography Research

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Summary of Completed Project

The purpose of this award was to partially fund the acquisition of a high-sensitivity, automated mass spectrometer system dedicated to the analysis of carbonate samples. The acquisition was jointly funded by this award, by an award from the National Science Foundation Division of Ocean Sciences and by supporting funds from the Woods Hole Oceanographic Institution. We purchased a Finnigan MAT252 mass spectrometer with an automated carbonate device known as the "Kiel device". The instrument was delivered in December 1992. It was installed in March 1993 and met factory specifications within three weeks. Routine operational use of the system began in March 1993.

The system has been run in a routine fashion for the last 16 months. During that time we have analyzed more than 14,000 samples and standards. The routine precision for $\delta^{13}C$ is ±0.03‰ and for $\delta^{18}O$ is ±0.07‰ (Figure 1). But precision varies as a function of size. For samples larger than about 50 μg, precision is excellent and relatively constant. Below 50 μg, precision degrades. For standards with masses between 10 and 20 μg, precision for $\delta^{13}C$ is ±0.09‰ and for $\delta^{18}O$ is ±0.20‰ (Figure 2).

Samples analyzed by this instrument have supported research by seven NSF funded researchers, three graduate students and two Summer Student Fellows. We have studied Arctic, North Atlantic, Caribbean, and Indian Ocean sediment cores. In addition the system has been used to study foraminiferal samples collected in sediment traps from the Atlantic and Indian Oceans.

Publications Supported by this Award

Keigwin, L. D. and Jones, G. A., 1994. Western North Atlantic evidence for millennial-scale changes in ocean circulation and climate. Journ. of Geophys. Res., v. 99, pp. 12397-12410.

Keigwin, L. D., Curry, W. B., and Lehman, S. J., in review. The climate-deep ocean link during interglacial stage 5. Submitted to Nature.

Slowey, N. C. and Curry, W. B., in review. Glacial-interglacial differences in circulation and carbon cycling within the upper western North Atlantic. Submitted to Paleoceanography.

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Oppo, D. W., Raymo, M. E., Lohmann, G. P., Mix, A. C., Wright, J. D., and Prell, W. L., in review. A $\delta^{13}C$ record of Upper North Atlantic Deep Water during the past 2.6 million years. Submitted to Paleoceanography.

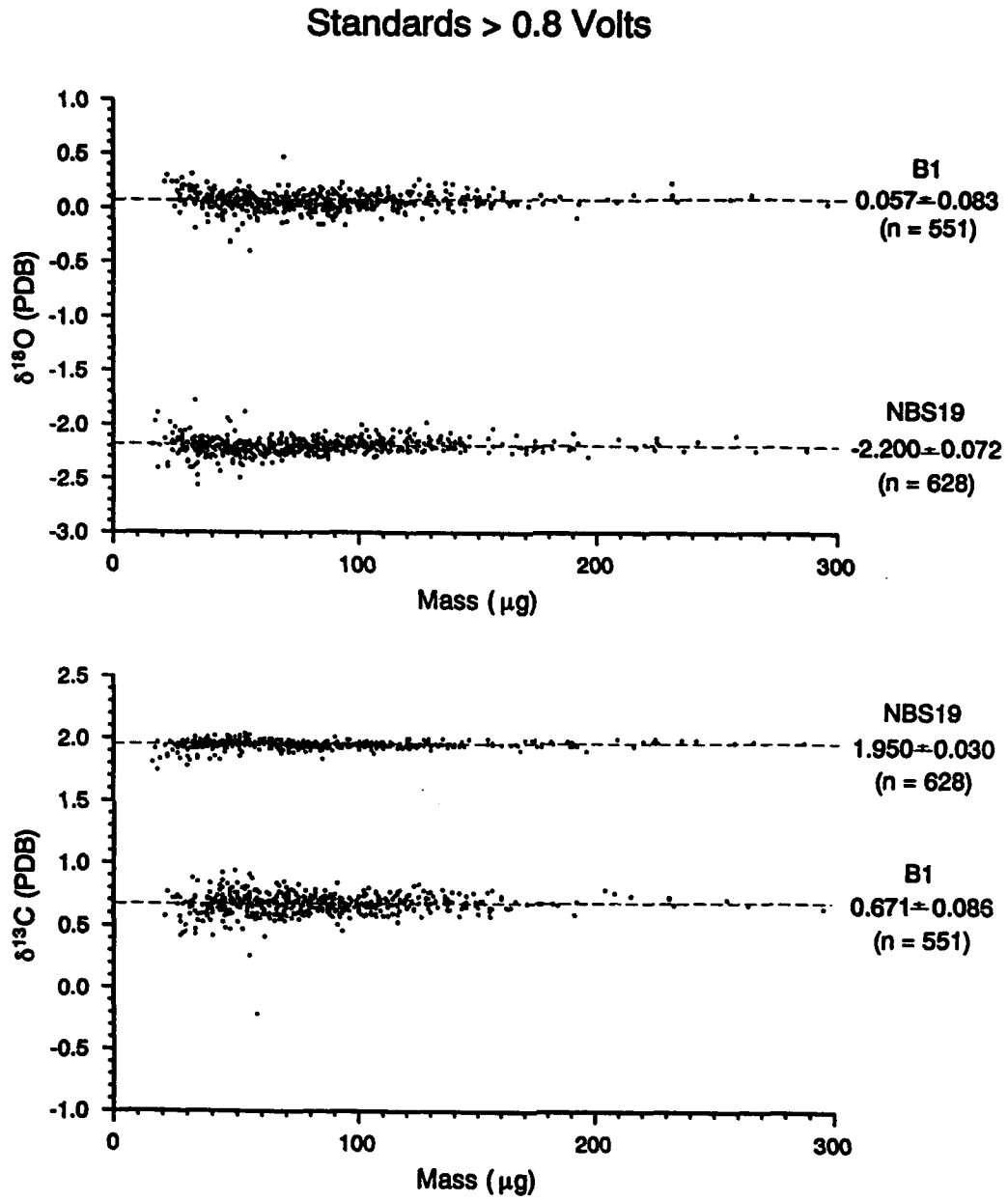

Figure 1. Isotopic measurements of two standards which are routine analyzed in our mass spectrometer. NBS19 is the standard we use to calibrate our data to PDB. B1 is the standard used by C. Emiliani. We analyze at least three standards of different isotopic composition for every carousel of samples.

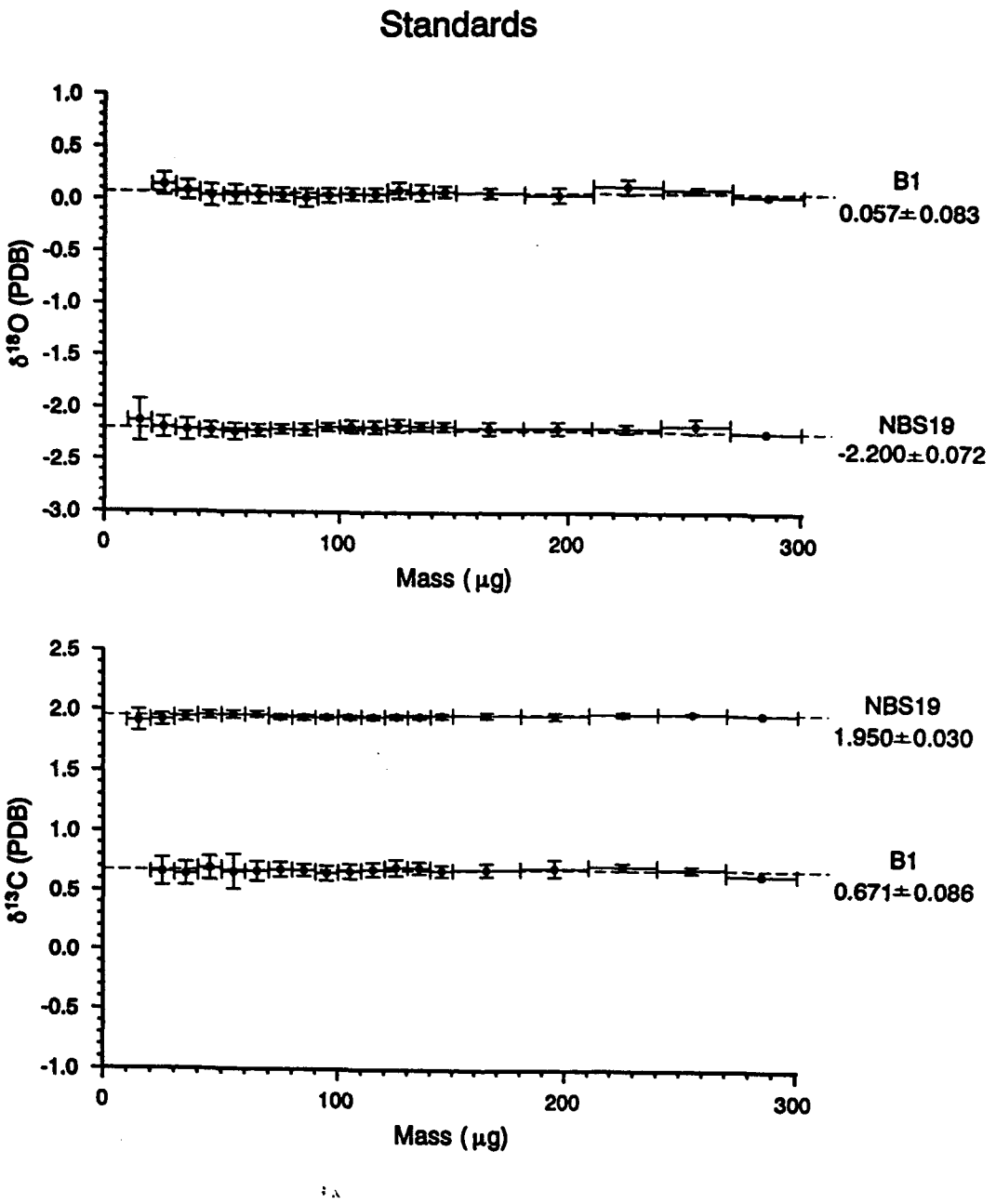

Figure 2. Precision of isotopic analyses for standards, binned within specific mass intervals. For masses greater than 50 μg, precision is excellent and constant. Below that size precision degrades; for the mass interval 10 to 20 μg, precision for δ13C is ±0.0‰9 and for δ18O is ±0.20‰.